The CTPP Workplace Data for Transportation Planning: A Systematic Review

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ABSTRACT

The Census Transportation Planning Products (CTPP) data has been a valuable resource for transportation planning community, providing information about where people live and work, their journey-to-work commuting patterns, and their socioeconomic and travel characteristics. While the CTPP data has been widely utilized by transportation planning agencies and researchers as a key input for various transportation planning subject areas including, but not limited to, travel demand modeling, descriptive statistics, policy and planning strategies, environmental analyses, and survey and sampling methods, the CTPP Oversight Board believes that the CTPP workplace data is underutilized. To understand the potential enhancements to the CTPP workplace data for better utilization in the future, this paper provides an overview of the CTPP and other data products that have been widely utilized in transportation planning and research, such as the Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) and the National Household Travel Survey (NHTS), and then, discusses the strengths and limitations of the CTPP workplace data as compared to those two data products. In addition, this paper summarizes the previous and current utilization of the CTPP data by reviewing over 300 studies that cited the use of the CTPP data, and identifies the key subject areas and the emerging topics of those studies.

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INTRODUCTION

The Census Transportation Planning Products (CTPP) program is a Technical Service Program of American Association of State Highway and Transportation Officials (AASHTO), funded by member state transportation agencies. The CTPP data is a set of special tabulations from American Community Survey (ACS) data, designed for transportation community. The CTPP data has been a valuable resource for transportation planners and researchers, and it has been utilized for various transportation planning subject areas including, but not limited to, travel demand modeling, descriptive statistics, policy and planning strategies, environmental analyses, and survey and sampling methods. The CTPP provides invaluable information about where people live and work, their journey-to-work commuting patterns and their means of transportation to work. One of the unique features of the CTPP data product making it different from other Census data products is that it provides more workplace based tables than the ACS data. CTPP workplace data, one of three components of the CTPP data product, provides detailed workplace based socioeconomic and travel characteristics information for workers, although the CTPP Oversight Board believes that the CTPP workplace data has been underutilized.

The main goal of this paper is to assist the CTPP Oversight Board in the development of future workplace data with the purpose of encouraging transportation planners and researchers to better utilize the CTPP workplace data. The objectives of this paper are (1) to explore the multiple data products relevant for transportation planning, (2) to discuss about the strengths and limitations of the CTPP as compared to other products, (3) to summarize a variety of previous and current uses of the CTPP and its workplace data, and (4) to suggest potential enhancements to the CTPP workplace data for better utilization. To examine the strengths and limitations of the CTPP workplace data, this paper conducts a comparative analysis between the CTPP and other data products such as the Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) and the National Household Travel Survey (NHTS). And then, to better understand the utilization of the CTPP data, this paper conducts the literature review of the 305 studies that cite the use of the CTPP data and summarizes those studies by subject area.

DESIGN COMPARISON OF WORKPLACE DATA PRODUCTS

Analyzing characteristics of workplace is crucial for understanding and mitigating traffic congestion, commuting patterns, environmental justice, and so forth. The analysis requires reasonable and accurate dataset. Transportation planners have utilized numerous national and local datasets, including but not limited to the CTPP, the LODES and the NHTS. Each workplace data product has its owns strengths and limitations. It is important to use the appropriate data for certain types of analysis. This section explores the multiple data products that have been widely utilized in transportation planning and research, and then, discusses the strengths and limitations of the CTPP workplace data as compared to those products.

Overview of Workplace Datasets

American Community Survey (ACS) Data

Data is a mandatory component in both qualitative and quantitative analyses. An accurate and comprehensive dataset gives an advantage of unfolding many insights of a subject (i.e. means of transportation by household income in urban and rural areas, commute time by age compositions by minority status); thus, it will help to produce a high-quality and empirical finding. The U.S. Census Bureau (Census Bureau) produces many useful and publicly available tools and datasets that are used by various sectors such as governmental agencies, private companies, non-profit organizations, universities, etc. The Census Bureau is a federal government overseen by the Economics and Statistics Administration (ESA), which is a part of the Department of Commerce (*1*). The Census Bureau produces two major datasets with information about commuting: ACS and the LEHD. Within each of these datasets, it provides detailed information related to workplace and commuting characteristics. These datasets are crucial and useful for transportation planners.

Within each of the described datasets, they have special tabulations dedicated specifically to transportation planning (i.e. CTPP and LODES). It is important to know the background of the CTPP, which is a subset of the ACS. The Census has been conducting an annually continuous social and economic survey called ACS since 2005; this particular survey was created to provide information more frequently and eventually replaces the decennial long form in 2010 (*2*). The responses of ACS are combined and available at one-year, three-year, and five-year (1-, 3-, and 5-year) period estimates (The last ACS 3-year estimates were for 2011-2013 and have been discontinued since 2014); it means that these estimated periods represent the social and economic characteristics over a specific data collection time frame (*3*). Of course, the decennial census—during the period between 1960 and 2000—provided much more in-depth and diverse information because of its sample size, but its frequency was an issue. With the ACS, the Census can release yearly up-to-date information of social and economic data for communities within the U.S. For example, the results from the ACS allows a city to examine the changes of commuting time for minority population every year for its environmental justice analysis. The data compilation and estimation within the ACS can provide an opportunity for data users to analyze trends and compare across geographical units (i.e. states, counties, cities, communities, census tracts) and population groups.

The decennial census mailed out survey questions of households nationally; for instance, about 17% of all U.S. households (about 19 million) were sampled with the long form in Census 1990 and 2000 (*2, 5, 6*). The ACS, as mentioned, was created to improve the decennial census (*4*) because of its frequent data availability; however, the accuracy of the ACS data is not as high as the decennial census due to its sample size. Per Census, the ACS 1-year surveyed roughly 3%of all U.S. households (about 3.5 million) and group quarters such as military barracks, nursing homes, and prisons. For the 5-year estimates, the sample size of the ACS is less than 10% of all households in the U.S. (about 11.5 million) The Master Address File (MAF) was used to randomly select households during the ACS survey period; and, these households should not be selected again within five years (*2*). The MAF is a comprehensive database that contains the latest address information, location codes, source, and history data for U.S. residents (*5*).

The questionnaires in the ACS are similar to the traditional long form, which includes questions about socio-demographic, housing, economic, and journey-to-work. The sampling periods of the ACS depict the availability of its geography (i.e. large, medium, and small). For one-year estimates, the data is available only at large areas of 65,000 population and over. For three-year estimates, the data is available at medium areas of 20,000 population and over. For five-year estimates, the data is available in the smallest areas (e.g. census tracts and census block groups), which represent between 600 to 3,000 resident populations. The ACS five-year estimates (2006-2010) have the smallest sampling errors comparing to one- and three-year estimates due to its sample size of roughly 11 million housing units; however, it still has a higher margin of error (MOE) than the 2000 decennial census of 18 million sample size (*7*). It is obvious that larger sample size has better quality but it is expensive and time-consuming.

Census Transportation Planning Products (CTPP) Data

The ACS estimates have produced a rich database for many special tabulations related to social, demographic and economic characteristics, home and work locations and commuting flows; these tabulations that have been utilized by many transportation planning agencies as a key input to various transportation-related policies and planning efforts (e.g. corridor and project studies, environmental analyses, emergency operations management). Due to its usefulness and demand of such tabulations, the CTPP program was created through a pooled fund and collaborative effort between the Census Bureau, the Department of Transportations (DOTs), State DOTs, the AASHTO and TRB Committees. In addition, CTPP has been utilized for model validation and calibration purposes by MPOs and DOTs in their long-range transportation plans (*2*).

The CTPP predecessors were called Urban Transportation Planning Package (UTPP) and Urban Transportation Package (UTP) in 1980 and 1970, respectively. In 1990, the UTPP changed its name to the CTPP, and 2006-2010 CTPP has been using ACS five-year estimates to process the unique tabulations related to transportation (*8*). These packages used the decennial census long form data to generate special tabulations. The 2000 Census was the last one to include the long form, and after that, all questions related

to commuting were moved to ACS. Consequently, CTPP datasets produced after 2000 Census were based on ACS data, which is the only source for information on commuting and several other demographic characteristics. The latest CTPP data was generated using ACS 2006-2010 five-year estimates and was released in 2013. These special tabulations are available at transportation analysis districts (TADs), transportation analysis zones (TAZs) and census tracts. TADs and TAZs are defined by states and MPOs. CTPP provides special tabulations for residence, workplace and flows between home and work. The advantage of having these tabulations is the capability to analyze detailed information related to residence, workplace, and commute flows. For instance, the commuting flows of the workers can be customized to analyze the difference in average commuting times between low-income and high-income workers from location A to location B.

Longitudinal Employer-Household Dynamics (LEHD) Origin Destination Employment Statistics (LODES) Data

Another major transportation planning dataset produced by the Census Bureau is the LODES, which is a collaborative effort between the Census Bureau and Departments of Labor in various states. LODES data is not available for all states due to data unavailability and data sharing limitation (*9*). Like the CTPP, the purpose of this program is to explore the local employment dynamics by connecting residence and workplace with each other. The LEHD provides detailed information on the local labor market based on actual administrative records; the census uses such information to improve its economic and demographic data programs (*9*). This dataset can be utilized to investigate various workplace-related topics such as firm size, earnings and commuting flows. The LEHD is known as another potential data source, besides the CTPP, that provides information regarding workplace characteristics and commuting flows.

One unique feature of the LEHD dataset is that it uses administrative data, which covers more than 95% of the total workforce in the U.S. (*3*). This data includes information from State Quarterly Census of Employment and Wages (QCEW) and federal administrative records. The QCEW program publishes employment and wages information from employers within the U.S. at various geographical levels (i.e. county, metropolitan statistical area (MSA), state and national) by detailed industry. The QCEW primarily collects workplace characteristics from administrative records of all private sectors, and local and state governments covered under the State Unemployment Insurance (UI) programs. In addition, the Annual Refiling Survey and the Multiple Worksite Report from the Bureau of Labor Statistics (BLS) are also used to supplement the missing data gap of QCEW microdata. Under the LEHD program, the mentioned data sources about firms and workers are combined to tabulate job level quarterly earnings, workplace and residence information, and firm characteristics (e.g. industries). The LEHD program, since 2012, has included federally-employed (not including military jobs) and self-employed workers. The employment data of federal employees is obtained from the U.S. Office of Personnel's Management and the self-employment data is collected from tax files. It is important to understand how the LODES data computes its job counts. A job is counted only if the employee is employed at the same place in both first quarter (previous) and second quarter (current). The LODES data files are state-based and organized into three types: origin-destination (OD), residence area characteristics (RAC), and workplace area characteristics (WAC). The LODES data is available for most states for the years 2002-2014, and the latest LODES data was enumerated by 2010 census block. The LODES data has been integrated into a web-based map application called OnTheMap, an online mapping and reporting application, that shows where workers are employed and where they live.

National Household Travel Survey (NHTS) Data

Another major dataset in the transportation planning field is the NHTS. This dataset has been referenced and utilized by transportation planners to assist them in understanding the travel patterns and behaviors in the U.S. According to the 2017 compendium of uses, there were 198 reports and papers that utilized the NHTS in 11 categories (i.e. Bicycle & Pedestrian Studies, Energy Consumption, Environment, Health, Policy and Mobility, Special Population Groups, Survey, Data Synthesis, & Other Applications, Traffic Safety, Transit Planning, Travel Behavior, and Trend Analysis & Market Segmentation) (*10*). The major

usage of the NHTS is to explore travel behavior, which is important for program initiatives, review programs, and policies, mobility issues, and long-range plans. The NHTS is not updated as frequently as other datasets (i.e. CTPP, LODES); a total of eight NHTS was conducted between 1969 and 2017. The NHTS was known as the Nationwide Personal Transportation Surveys (NPTS) prior to 2001.

The NHTS dataset collects daily travel information—that means the data is collected from trips within the 24-hour time frame. The questionnaires in the survey ask for trip purpose, modes, travel time, departure time, departure date, vehicle occupancy, driver characteristics, and vehicle characteristics. The 2009 NHTS is organized into four different data files, including household file, person file, vehicle file and travel day trip file. Every time the survey is conducted, it always introduces new emerging variables. The 2009 NHTS data includes unique information such as telecommuting, public perceptions of the transportation system, internet usage, and active transportation trips. Users of the NHTS have also identified additional variables needed for future collection; these extra variables are costs of travel, specific travel routes, travel of the sampled household changes over time, household and workplace location, traveler's reason for selecting a specific mode of travel over another mode (*11*). The latest 2016 NHTS recently completed its data collection phase in April 2017. There were slightly more than 129,000 households participating in the survey. The 2016 NHTS data is scheduled to be publicly available in early 2018.

The Add-on Program is unique for the NHTS. This program provides an opportunity for states and MPOs to purchase additional samples of the household travel survey that are compiled into a geocoded database within their jurisdictions for more localized transportation-related planning and forecasting. The location file of the Add-on deliverables provides latitude and longitude of origin and destination address and is linked with the four main files by household ID, person ID and trip ID. In 2016 NHTS, nine state DOTs and four councils of governments (COGs) were add-on partners, including Arizona, California, Georgia, Maryland, New York, North Carolina, South Carolina, Texas, Wisconsin, Des Moines Area MPO, Indian Nations COG, Iowa Northland Regional COG, and North Central Texas COG (*10*).

Strengths of CTPP and other datasets

The CTPP provides useful special tabulations for transportation planning purposes from using sample dataset (e.g. ACS 5-year estimates) to statistically represent all areas within the U.S. This data is available at various geographical units such as county, place, tracts, and so forth (*3*). The CTPP is derived from the ACS, and therefore, it allows users to analyze workplace and travel patterns with more customized tabulations than the LODES. CTPP includes unique variables and cross-tabulations at small geography (i.e. TAZs or census tracts) at three summary levels, which are residence geography, work place geography, and home-to-work flows (*2*). These tables are tabulated from the ACS dataset. The CTPP has undergone a tremendous improvement in its contents from 1990 to 2010, and consequently, the data has added more customized tables and enhanced statistical processes (*2*). Per Weinberger, in 2018, the tabulations in the CTPP will be reduced by roughly 30% of the current 2006-2010 CTPP version but it will still have more workplace information than the LODES. Another unique feature of the CTPP is the freedom for users to create customized reports based on interested geographical units (i.e. census tracts) or demographic variables (i.e. low income, minority, vehicle availability by household income). Additionally, as compared to the LODES, the CTPP includes several unique transportation-related variables such as mode choice and travel time (*12–14*). The CTPP application provides OD flows for several special tabulations such as poverty status, minority status, travel time, age of worker, industry and more.

As compared to the CTPP, the LODES provides information on workplace and commuting flows at a finer geography (down to the census block level), while the LODES provides less workplace characteristics than the CTPP. Spear has stated in his report of "NCHRP 08-36, Task 098 Improving Employment Data for Transportation Planning" that the CTPP 2000 and 2006-2008 datasets include more OD flows than the LODES data. Spear also suggested combining the CTPP with the LODES "to smooth out the geographic distribution of home-to-work trips, and to develop more complete areawide OD matrices for home-based work trips that could be used in travel modeling applications" (*14*). In 2003, one study has evaluated feasibility of generating workplace data from LEHD program (*15*); the author has stated that the CTPP captures more internal trips (i.e. people who live and work in the same tract), which is an important

variable for transportation planning. The study found that census tracts with internal trips are higher in the CTPP as compared to the LEHD. Furthermore, the reason behind the difference in internal trips between these workplace datasets may be "attributable to the LED data capturing only those employers who pay unemployment insurance, missing self-employed worker" (*15*). Also, the result of the statistical linear model has shown better fitness with the CTPP than the LEHD. Overall, it is a major drawback that the LEHD does not have detailed information of residence and workplace (i.e. mode choice, travel time, self-employment)—comparing to the CTPP.

Compared to the CTPP and the LODES, the NHTS provides more detailed variables of households, persons, travel day trips, and vehicles and long distance trips (*16*). This data also provides specific information of travel behaviors of people on multiple trip purposes (e.g. shopping trip, recreational trip). The NHTS provides travel characteristics during weekends, which makes it unique (*17*). In addition, the NHTS committee has been actively collecting feedbacks and comments from data users to improve the next version of the NHTS. There are several improvements from the 2001 to 2009 NHTS based on the Summary of Travel Trends 2009 NHTS. Besides the general adjustments (i.e. data collection, odometer reading, eligible household members) to the 2009 NHTS, the survey has also incorporated emerging transportation-related questions about 1) safe routes to schools, 2) hybrid vehicles, 3) detailed work-related travel questions (i.e. whether the worker can set or alter their work schedule, whether the worker has the option of working from home, frequency of working at home, and self-employed status), and 4) online shopping and shipping. The survey has also improved its geocoding technique. Instead of post-processing location data, it uses the real-time interactive online tool during the interview to geocode locations. Similar to the CTPP dataset, the NHTS utilizes the census population estimates for its final adjustment.

Limitations of CTPP and Other Datasets

The CTPP special tabulations are derived from a continuous survey called the ACS, which surveys roughly 3.5 million U.S. households annually. To produce CTPP tabulations at small geographies (e.g. census tracts) with low MOE, ACS five-year estimates are used because of their its sample size relative to the one-year data. This makes it difficult to perform temporal analyses using the CTPP dataset (*2, 13*). The CTPP only accounts for workers of age 16 and older, primary jobs, and institutionalized group quarters. The responded workplace locations may not be accurate because some jobs require workers to travel to multiple places (i.e. construction workers or employees attending the conference). Due to confidentiality, some of the information is suppressed, which results in unsatisfactory statistical reliability (*3, 18*). This statistical issue also occurs in the LODES and the NHTS. The suppression factor is related to the geographic detail available in each data source. The more geographic detail, the greater the chance there is suppression and the more error created by suppression. The CTPP does not include non-work trips such as shopping, school, recreational, and so forth as the NHTS does. It does not include trip chain information. For instance, an individual may drive to the Park-and-Ride, take the train to work, and Uber home.

Although CTPP provides detailed data on workplace and OD flows at small geographic level, the LODES provides more geographically detailed data (i.e., census block level) when performing small area analysis related to workplace and OD flows (*12, 13*). Also, the commute distance is not reported in the CTPP dataset (*12*). The CTPP may not cover an entire range of workers because, if workers who were on vacation or sick leave during the survey time-frame, they will not be included in the survey. Not every response may be accurate due to misreporting of workplace geocoding. For workplace address, it sometimes cannot be geocoded correctly because of missing address information. For example, it is difficult to accurately assign a worker who works for Boeing in Seattle without a proper address because of many Boeing offices. The unidentified or un-geocoded workplace will be assigned to the county and place level (*3, 19*). The CTPP has roughly nine to ten percent of workplace records geocoded to county or place level, which may be difficult to be further allocated to TAZ or census tract level.

It is difficult to perform quality control on the survey data because the survey respondents may respond inaccurately, which results in reporting errors (*2*). In September 2005, there was an intense debate about the 2000-2004 ACS data used to process the CTPP, in replacement of the 2000 decennial census. One of the issues that were raised in the debate was about the "errors in the annual ACS data for 2000–

2004 are very large and the data cannot be used to make rational conclusions in transportation planning" (*20*). Though the errors have been improved over time (e.g. 2011-2015 ACS 5-year estimates), it is important to keep improving the data quality. These quality issues occur due to low sample size. CTPP data users have also raised the possibility of eliminating some of the smaller geographies such as TAZs, because these tables have the most impacts. Estimates for larger geographies are much more stable due to their larger sample size. Furthermore, the ACS uses population estimates as population controls for its weighting methodology, instead of actual census counts (*3, 20*). As compared to the CTPP, the LODES collects actual administrative records and collaborates with states to get consistent socioeconomic counts.

Although CTPP provides more variables and covers all areas in the U.S. as compared with LODES (*21*), the CTPP commuting flows (i.e. CTPP 2000, CTPP 2006-2008) do not include low-frequency OD pairs (e.g. work trip using bicycle or trips between distant zones) because the CTPP is based on sampled data. Therefore, the LODES delivers more realistic home-to-work flows than any other sample-based datasets like the CTPP. Because the CTPP datasets are developed from using sampled data, it may omit some low-frequency OD pairs that are not captured by the surveys, which may not provide a clear picture on commuting patterns. In transportation analysis and modeling, the sample weighting methodology is used widely to expand survey data to estimate the universe of home-to-work trips (*14*). For instance, low frequency OD flows may not get captured and will be assumed a zero probability of occurrence in the statistical model—this will assign more weight to other trips. Spear also explained that "OD pairs with a low frequency of home-to-work trips that are sampled in the CTPP get weighted more heavily, while low frequency OD pairs that are not sampled are assumed to have no home-to-work flows" (*14*). This is a downside of using sampled data because not every aspect of OD flows can be captured.

Because the NHTS and the CTPP are produced from surveys, both use a statistical method to generalize the survey responses to represent all population characteristics in the U.S. There are two types of errors when conducting a survey, which are non-sampling error and sampling error. As explained in the 2011 Summary of Travel Trends 2009 NHTS and NHTS Task C: Sample Design in 2017, non-sampling error may have resulted in several discrepancies: these include "the inability to obtain information about all persons in the sample; differences in the interpretation of questions; inability or unwillingness of respondents to provide correct information; inability of respondents to recall information; errors made in collecting and processing the data; errors made in estimating values for missing data; and failure to represent all sample households and all persons within sample households (known as under-coverage)" (*22*). On the other hand, the sampling error refers to when the sampled group's estimates don't represent the true population values. Confidence interval (CI) or MOE is used to examine and control the quality of estimates.

On the other hand, the LODES has several limitations related to employment coverage, data availability, data continuity, and geography. The definition of workplace may be misinterpreted for the LODES; it means that "an address from administrative data may or may not be the actual location that a worker reports to most often" (*3*). One example of this is the employees within the construction industry. Their workplaces are varied depending on the projects. The LODES dataset does not cover a full range of employment; the employment groups that it does not cover are self-employment, military employment, the U.S. Postal Service and informal employment. Limited workplace-related variables are also another limitation of the LODES. As compared to the CTPP, the LODES does not include as many variables, such as means of transportation, travel time to work, vehicle available and poverty status. Another limitation is data discontinuity. For certain variables, the LODES dataset does not have a consistent set, which makes it hard to perform longitudinal analysis. For instance, it is impossible to track down the changes of ethnicity of employees for the last ten years because this variable only became available from 2009. Finally, the geography of LODES is not available for the whole U.S. as the LEHD program is a voluntary program.

Compared to the CTPP and the LODES, the NHTS is not frequently updated. The NHTS survey is conducted roughly every five to ten years. Moreover, workplace data is not a part of NHTS's main data files, although the location file of the NHTS Add-on deliverables provides the detailed location information of origin and destination address and users can link the location file with the four main files by household

352 ID, person and trip ID. The NHTS does not include contain specific information on costs of travel,
353 information about specific travel routes or types of roads used, or travel of the sampled household changes
354 over time, and the traveler's reason for selecting a specific mode of travel over another mode. Table 1
355 summarizes the characteristics of the CTPP, the LODES and the NHTS.
356
357 Table 1. Characteristics of the CTPP, the LODES and the NHTS
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Categories	CTPP (ACS)	LODES (LEHD)	NHTS
What is the main source of data?	Used ACS to create special tabulations on commuting characteristics including residence and workplace.	Used LEHD dataset which from administrative records.	Used customized survey to randomly survey households on travel behaviors.
What is the sample size?	2006-2010 5-year CTPP was derived from ACS 2006-2010 5-year estimates (roughly 10% of all U.S. households).	Collected administrative records from 50 states via UI program and Office of Personnel.	2016 NHTS surveyed roughly 129,000 households. Add-On Program allows agencies to purchase additional data.
What is data coverage?	Provides special tabulations for residence, workplace and flows between home and work for the whole U.S.	Provides origin-destination (OD), residence area characteristics (RAC), and workplace area characteristics (WAC) for most states.	Survey samples represent all areas within the U.S.
How frequent does it update?	2006-2010 5-year CTPP is based on 2006-2010 ACS. The next version of CTPP uses 2012-2016 ACS. Release roughly every five (5) years.	Available annually since year 2002 with the exceptions of some states.	Release roughly every 5-10 years. The 2016 NHTS Public Use Data will be released in early 2018.
What workplace information does it have?	Have 115 workplace based tables for over 200,000 geographies. Standard tables include workplace location, commute mode, departure time from home, arrival time to work, travel time (minutes), sex, age, race, ethnicity, citizenship status, language spoken, earnings, poverty status, occupation, industry, class of worker, hours worked each week, weeks worked in the past 12 months, earnings,	Provides workplace characteristics (i.e. firm size, firm age, NAICS industry sector, work location) and worker characteristics (i.e. primary/secondary job, earnings, education, age, gender, ethnicity, house location).	The NHTS Add-on deliverables provides the detailed location information of origin and destination address, which can be linked with main data files. The main data files includes characteristics for each household, person, worker, vehicle, and daily travel data. For each worker, NHTS provides information on full/part-time, number of jobs, job types, workplace location, usual mode, distance, and

	number of vehicles available, household size, number of workers in household.		arrival time to work, drive alone/carpool, and flexibility in work arrival time.
What is the smallest geographic unit available?	Transportation analysis zones (TAZs)	Census blocks	Latitude and longitude of trip ends (for Add-ons only)
Who is included in the survey?	Collects employment characteristics from workers of 16 years and over including telework and non-institutional group quarters (i.e. college dormitories and military barracks). On the other hand, the data does not capture secondary job and excludes workers living in institutionalized group quarters such as prisoners and nursing homes.	Includes all ages of workers. It includes all jobs under state UI law, which is 95% of private sector wage and salary employment. Also, it covers most of civilian federal employment using records from the Office of Personnel. Does not cover self-employment, military employment, the U.S. Postal Service, and informal employment.	Includes civilian, non-institutionalized population of the U.S. of five year-and-older. It excludes institutionalized group quarters (i.e. motels, hotels, nursing homes, prisons, barracks, convents or monasteries and any living quarters with 10 or more unrelated roommates.
How does it geocode residential/employment?	92% of worker records are successfully geocoded to place level. The leftover cases are allocated to a workplace location for geographies down to the place level.	Geocode using detailed addresses within the administrative records, which is 95% of private sector wage and salary employment.	Uses online interactive tool to real-time geocode during the interview process.

USES OF THE CENSUS TRANSPORTATION PLANNING PRODUCTS (CTPP) DATA

Literature Review

This paper discusses the myriad uses of the CTPP data and its workplace data in transportation planning and research. In order to review the research subject areas, methodologies and data sources of the literature and studies that utilized the CTPP data, this study searched journal articles, dissertation, reports, and conference presentations that cited the use of the CTPP data from academic libraries, journal websites such as the Transportation Research Board (TRB)'s Transportation Research Record: Journal of the Transportation Research Bard (TRR Journal) Online website and Journal of American Planning Association (JAPA) online access, various conference publication websites, and Google search engine results pertaining to CTPP data. The key word and search engine terms used were "Census Transportation Planning Products", "Census Transportation Planning Package" or "CTPP". The resulting literature and studies were examined to select those that are most relevant to this study. The literature and studies reviewed in this paper cover a diverse range of subjects in transportation planning including, but not limited to, modeling, policy, demographics, equity, survey and general planning issues.

This paper reviewed 305 studies that cited the use of the CTPP data. The publication dates of those studies range from 1989 to 2017 and their publication types included journal articles, dissertation/thesis, books, reports, conference proceedings, and poster presentations. In this paper, those studies were grouped into 12 categories based on the primary subject area identified in their abstracts, although there is, of course, much overlap between these categories in many studies. Some studies were categorized into multiple

subject areas as they discuss multiple subject areas and no single subject area was considered the primary category. For the category classification, this paper reviewed previous similar studies and reports on the uses of the CTPP and NHTS (*1, 23*) and then classified 12 categories based on the review of subject areas and keywords of the 305 studies. Table 2 summarizes the list of subject areas used in this paper and their keywords. Appendix A contains a listing of the 305 studies examined in this paper, including their titles, authors, and subject area categories.

Table 2. Subject Areas and Relevant Keywords

Subject Area	Relevant Keywords
Bicycle & Pedestrian Studies	bicycle commuting, bikeway, off-road trail system, pedestrian, physical activity, walking
Built Environment & Accessibility Study	accessibility, built environment, decentralization of residence and employment, job accessibility, job opportunities, job proximity, land use intensity, polycentric city, spatial concentration, spatial inequality, spatial mismatch, sprawl, street connectivity, transportation infrastructure, urban spatial structure
Commuting Patterns & Job-Housing Mismatch	commute distance and time, commute flow, commute pattern, job-housing balance, journey-to-work trips, spatial relationship between residence and workplace, travel patterns
Demographics Study	baby boomers, demographic, gender, household attribute, immigrant population, income, millennials, neighborhood type, poor job seekers, race/ethnicity, socioeconomic characteristics, wage
Environmental Justice & Title VI	accessibility, education attainment, environmental justice, gender, impact equity analysis, immigrants, Limited English Proficiency (LEP), low income, low wage workers, minority, national origin, poverty, social equity, social impact, spatial inequality, Title VI, transportation cost and needs
Health, Safety & Environmental Issues	asthma, cholesterol, crime, electric power plants, electric vehicle charging, energy analysis, greenhouse gas reductions, environmental analyses, health impact, heat, plug-in hybrid electric vehicles (PHEV), obesity, ozone, vehicle emission
Policy Analysis	congestion management, congestion relief strategies, disaster relief strategies, enterprise zone policy, gasoline tax revenue, highway congestion pricing, park-and-ride, parking requirements, regulations, ridesharing, transit subsidies, transportation pricing strategies, urban containment policy, urban growth control
Survey, Data Synthesis & Research Methods	cellular data, data fusion, data matching, data synthesis, fuzzy clustering method, indicator development, interview, Iterative Proportion Fitting (IPF), methodology, model-based synthesis, sampling, synthetic data techniques, transportation indicators, travel survey
Transit Planning	bus rapid transit, bus transit system, commuter rail system, interurban rail trip, light rail, multimodal transportation, new transit services, public transit study, transit access, transit demand analysis, transit dependent populations, transit feasibility analysis, transit mode share, transit planning, transit propensity index, transit ridership, transit subsidies
Travel Behavior Analysis	behavior uncertainty, commuting behavior, driving alone, household travel, immigrants, individual characteristics, minority travel patterns, mode choice, segregation, social interaction, socioeconomic characteristics,

	travel behavior, travel pattern, travel-related characteristics, vehicle ownership, vehicle transit behavior
Travel Demand Modeling & Forecasting	activity based model, discrete choice model, freight model, gravity model, mode and destination choice model, model calibration and validation, multinomial logit, regional transportation plan, socioeconomic forecasting, surface model, travel demand model, travel forecasting, travel simulation, trip attraction model, trip distribution, trip generation, vehicle miles traveled
Trend Analysis & Market Research	Central Business District (CBD), changing patterns, economic centers, economic activity centers, economic structure, edge cities, edgeless cities, employment centers, housing price, inter-urban movements, Location Quotient (LQ), market analysis, population distribution pattern, spatial trend, sprawl, temporal dynamic, trend analysis, typology of land use patterns

Note: Subject areas and relevant keywords are sorted in alphabetical order.

Summary of the Uses and Applications of the CTPP Data

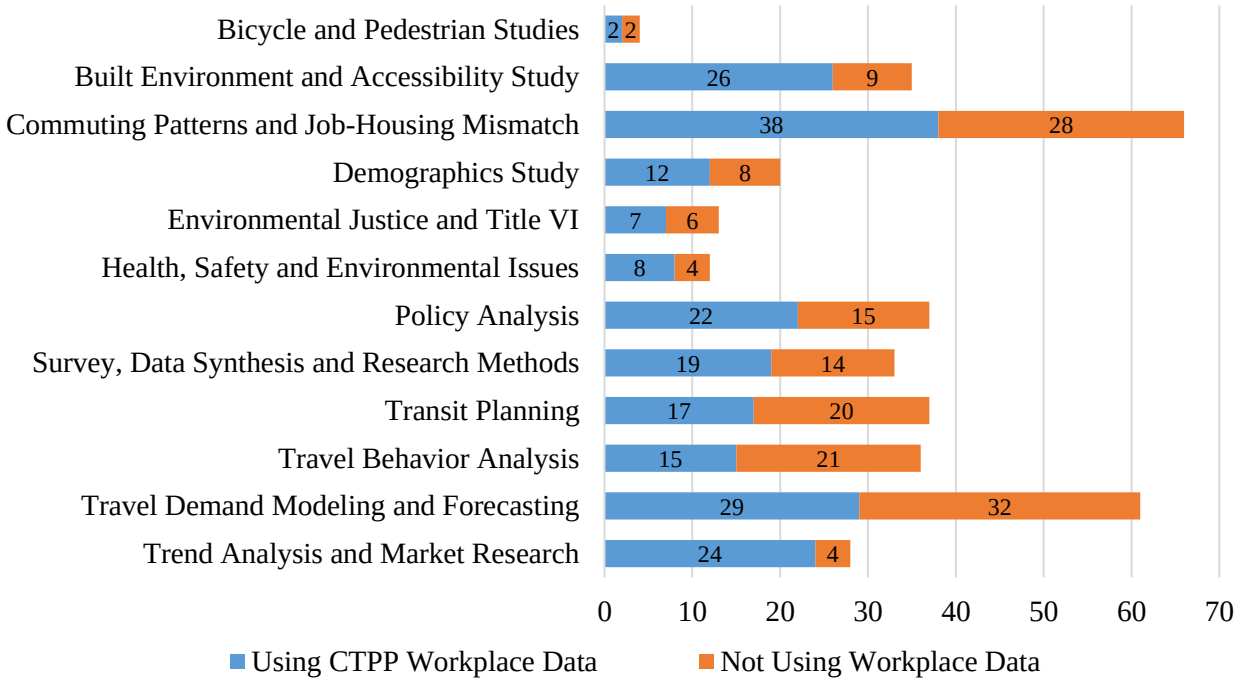
This section summarizes the various uses and applications of the CTPP data by subject area, based on the review of 305 studies that cited the use of the CTPP data. Among the CTPP's three component tables—Part 1 residence based tables, Part 2 workplace based tables and Part 3 home-to-work flow tables, it is observed that Part 2 workplace based tables was most frequently used, followed by Part 3 home-to-work flow tables, which indicates the CTPP workplace data is a critical component of the CTPP. Among the 305 studies, Part 2 workplace based tables were used in 179 studies (59%) and Part 3 home-to-work flow tables were used in 170 studies (56%) while Part 1 residence based tables were used in 127 studies (42%). It is observed that 126 studies (41%) used Part 1 residence based tables and/or Part 3 home-to-work flow tables only. The majority (73%) of those 126 studies that didn't use the CTPP workplace data utilized Part 3 home-to-work flow tables.

Figure 1 summarizes the uses of the CTPP data by subject area, comparing between studies that used the CTPP workplace data and studies that didn't use the CTPP workplace data. Among the 12 subject area categories, the most common uses of the CTPP data are Commuting Patterns & Job-Housing Mismatch and Travel Demand Modeling & Forecasting, followed by Transit Planning, Policy Analysis and Travel Behavior Analysis. It is observed that 66 of the entire 305 studies (22%) utilized the CTPP data for the subject of Commuting Patterns & Job-Housing Mismatch, 61 studies (20%) for the subject of Travel Demand Modeling & Forecasting, 37 studies (12%) for the subject of Transit Planning, 37 studies (12%) for the subject of Policy Analysis, and 36 studies (12%) for the subject of Travel Behavior Analysis. Of the 179 studies that cited the use of Part 2 workplace based tables, the five most common uses are Commuting Patterns & Job-Housing Mismatch (38 studies, 21%), Travel Demand Modeling & Forecasting (29 studies, 16%), Built Environment & Accessibility Study (26 studies, 15%), Trend Analysis & Market Research (24 studies, 13%), and Policy Analysis (22 studies, 12%). Of the 126 studies that didn't cite the use of the CTPP workplace data, the five most common uses are Travel Demand Modeling & Forecasting (32 studies, 25%), Commuting Patterns & Job-Housing Mismatch (28 studies, 22%), Travel Behavior Analysis (21 studies, 17%), Transit Planning (20 studies, 16%), and Policy Analysis (15 studies, 12%). The results indicate that the CTPP workplace data are useful especially for the subjects of Trend Analysis & Market Research, Built Environment & Accessibility Study, Policy Analysis, and Commuting Patterns & Job-Housing Mismatch.

Figure 2 summarizes the uses of the CTPP data by publication year. The publication dates of the 305 studies range from 1989 to 2017—27 studies before year 2000, 129 studies from year 2000 to year 2009, and 149 studies since year 2010. Of the 179 studies that cited the use of Part 2 workplace based tables, 16 studies were published before year 2000, 83 studies were published from year 2000 to year 2009, and 80 studies were published since year 2010. As shown in Figure 2, it is observed that the CTPP data has been increasingly utilized since year 2005. Among the entire 305 studies, 247 studies (81%) were published

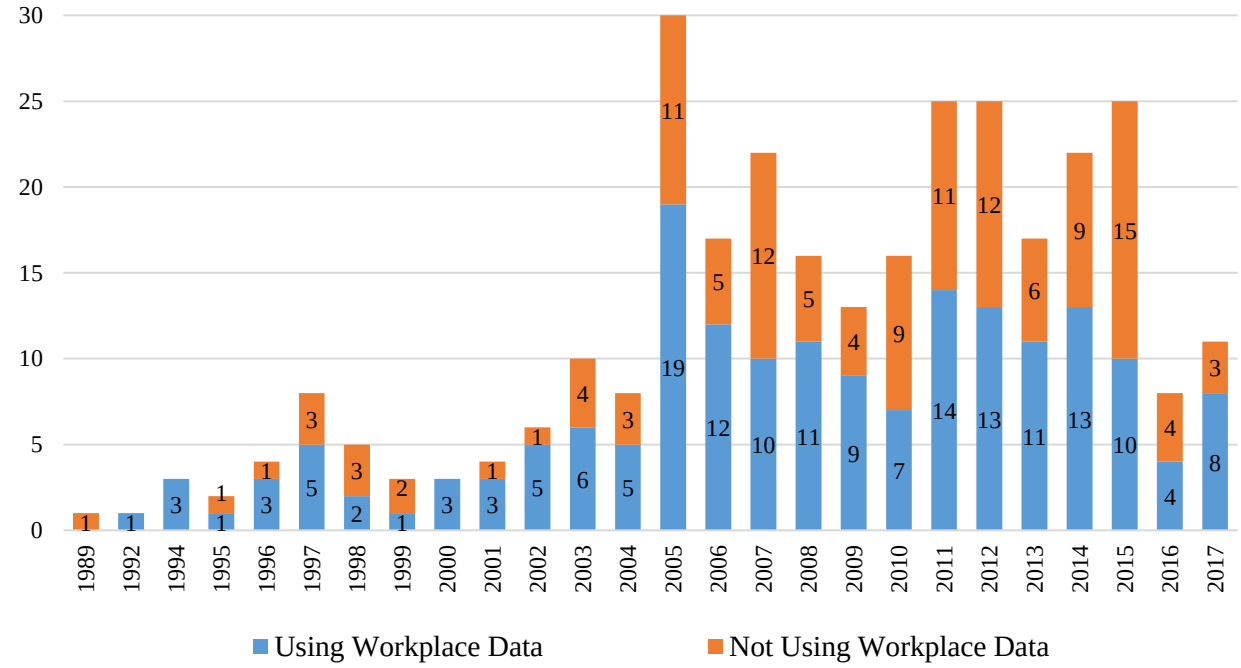
since year 2005, and among the 179 studies that used the CTPP workplace data, 126 studies (79%) were published since year 2005.

Figure 1. Uses of the CTPP Data by Subject Area



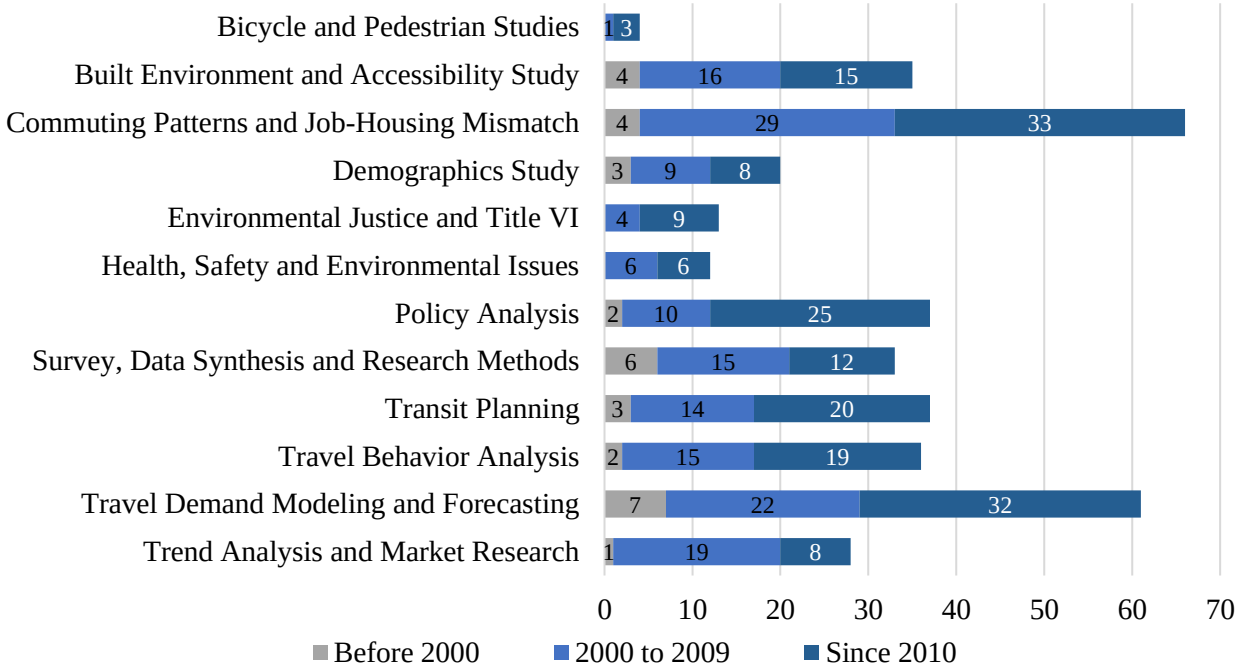
Note: Some studies were categorized into multiple subject areas as they encompass multiple subject areas and no one subject area was considered the primary category.

Figure 2. Uses of the CTPP Data by Publication Year



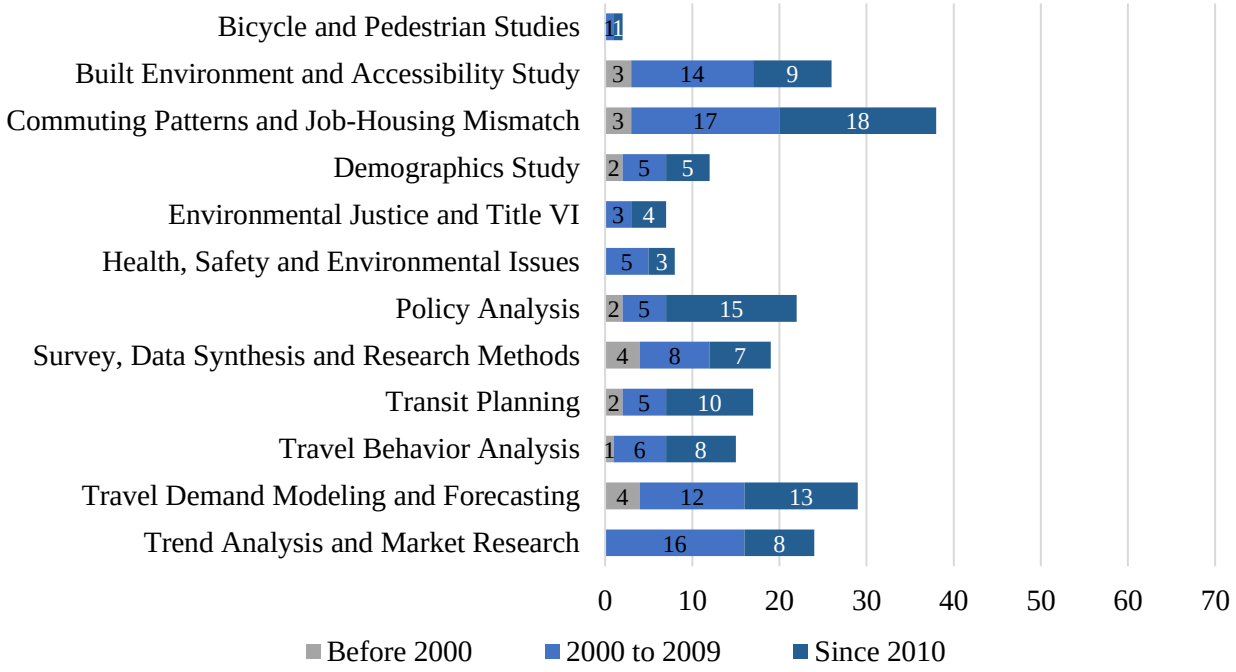
Figures 3 and 4 summarize the uses of the CTPP data and its workplace data by subject area and publication year. During review periods, two subject areas—Commuting Patterns & Job-Housing Mismatch and Travel Demand Modeling & Forecasting—have been constantly popular uses of the CTPP data. The subject of Commuting Patterns & Job-Housing Mismatch accounts for 4 of 27 (15%) studies published before year 2000, 29 of 129 (22%) studies published between year 2000 and year 2009, and 33 of 149 (22%) studies published since year 2010. The subject of Travel Demand Modeling & Forecasting accounts for 26%, 17%, and 21%, respectively. On the other hand, some subject areas such as Bicycle & Pedestrian Studies, Environmental Justice & Title VI, and Health, Safety & Environmental Issues are newly analyzed since year 2000. While there were no studies that cited the use of the CTPP data for those three subject areas before year 2000, those three subject areas, taken together, account 9% of 129 studies published between year 2000 and year 2009, and 12% of 149 studies published since year 2010. Of the 179 studies that cited the use of Part 2 workplace based tables of the CTPP data, Commuting Patterns & Job-Housing Mismatch, Travel Demand Modeling & Forecasting, and Built Environment & Accessibility Study have been constantly popular uses during review periods. The subject of Commuting Patterns & Job-Housing Mismatch accounts for 3 of 16 (19%) studies published before year 2000, 17 of 83 (20%) studies published between year 2000 and year 2009, and 18 of 80 (23%) studies published since year 2010. The subject of Travel Demand Modeling & Forecasting accounts for 25%, 14% and 16%, and Built Environment & Accessibility Study accounts for 19%, 17% and 11%, respectively. The results indicate that, during review period, the CTPP workplace data has been constantly utilized for a significant number of research on the subject of Commuting Patterns & Job-Housing Mismatch, Travel Demand Modeling & Forecasting, and Built Environment & Accessibility Study. In addition, the CTPP workplace data has been utilized in research on newly emerging subjects since year 2000 such as Trend Analysis and Market Research, Health, Safety & Environmental Issues, Environmental Justice & Title VI, and Health, and Bicycle & Pedestrian Studies.

Figure 3. Uses of the CTPP Data by Subject Area and Publication Year



Note: Some studies were categorized into multiple subject areas as they encompass multiple subject areas and no one subject area was considered the primary category.

Figure 4. Uses of the CTPP Workplace Data by Subject Area and Publication Year



Note: Some studies were categorized into multiple subject areas as they encompass multiple subject areas and no one subject area was considered the primary category.

Case Studies: Utilizing the CTPP Workplace Data in Transportation Planning and Research

This section introduces the case studies of how the CTPP workplace data is utilized in transportation planning and research. The purpose of this section is to explore some of the applications related to transportation planning and research that were performed using the CTPP workplace and to indicate how essential the CTPP workplace data was to the completion of the applications, including whether or not the data was essential; if the data was, what made them so; and, if the data was not essential, what information might have been substituted to complete the application.

Spatial and Socioeconomic Analysis of Commuting Patterns in Southern California: Using LEHD Origin-Destination Employment Statistics (LODES), Census Transportation Planning Products (CTPP) and ACS Public Use Microdata Sample (PUMS) (*24*)

As a part of environmental justice analysis of the regional transportation plan, the Southern California Association of Governments (SCAG) examined commuting distance by income to better understand the relationship between commuting pattern and socioeconomic characteristics in Southern California region. Multiple workplace data were used in this study, including the LEHD Origin-Destination Employment Statistics (LODES) Version 7.1 data, the Census Transportation Planning Products (CTPP) 5-Year 2006–2010 American Community Survey (ACS) data, and the 2009-2013 ACS 5-year Public Use Microdata Samples (PUMS).

Due to the differences in data structure, variable and geographic units among those three datasets, this study uses different methodologies to examine the relationship between commute distance and income level. Using the LODES data, this study examined the median commute distance, by wage group, for six counties in the region for the years 2002, 2008 and 2012. The commute distance measured is the Euclidean distance, straight-line distance, or distance measured “as the crow flies” between the centroid of origin block and destination block, and the commute distance is weighted by block-level commuter number. Given its minimum geographic unit is census block, the LODES data allowed this study to conduct analysis in a

more geographically detailed way than other two datasets. Using the CTPP data, this study examined the median commute distance by income group for six counties in the region. The commute distance measured is the Euclidean distance between the centroid of origin tract and destination tract and the commute distance is weighted by tract-level commuter number. As the CTPP data provides more detailed information of workplace compared to the LODES data, this study examined the median commute distance by additional CTPP variables, such as household income, poverty status and vehicles available. Using PUMS data, this study examined the median wages for inter-county and intra-county commuters to compare the median wages between workers residing in their destination-work-counties and outside their destination-work-counties. The most detailed unit of geography contained in the PUMS dataset is the Public Use Microdata Area (PUMA).

The results of this study showed the similar patterns in commuting distance by income group among LODES, CTPP and PUMS datasets: (1) higher wage workers tend to commute longer distance than lower wage workers; (2) the commute distance is growing in all 6 counties between 2002 and 2012; and (3) the commute distance of workers in inland counties (Riverside and San Bernardino Counties) is longer and grows more rapidly than in coastal counties (Los Angeles and Orange Counties). However, it was also observed that the median commute distance from the LODES data is longer than those from the median commute distance from the CTPP data, possibly resulting from differences between two datasets in data input source, data coverage, geographic tabulation level, time period and characteristics level.

Small-Area Applications Using 1990 Census Transportation Planning Package: Gainesville, Florida (*25*)
This study presents a case study of the main CTPP applications, limitations or problems encountered with the CTPP data, and results of the applications for the Gainesville Urbanized Area in its long-range transportation planning efforts. This study demonstrates that the CTPP provided detailed information about socioeconomic and travel characteristics that was unavailable from other sources and the CTPP data were of value during several stages of development of the Gainesville Urbanized Area 2020 Transportation Plan. The study focuses on how the CTPP was used to validate the travel demand model in preparation for the development and evaluation of multimodal alternatives for the plan. The study notes that the CTPP workplace data was the best source of employment data by TAZ. Several categories of employment by occupation were collapsed into the three required by TRANPLAN, the standard travel demand forecasting software used in Florida. The study also noted that some errors were observed during the validation data review process, e.g. misallocating employees of the University of Florida to a single TAZ located across the street from the campus.

The study underscored that the household travel survey for Gainesville was not up to date when preparing the plan and limited staff and financial resources required that the CTPP be used to identify key travel parameters to improve the accuracy of the forecasts. Despite some errors, the study highlights that the CTPP data was essential to the completion of the plan as it provided information unavailable from other sources. It also states that, without the CTPP data, the planning effort would have been less refined, would have had less public support and likely would have resulted in a different transportation plan than the one adopted.

Access to Growing Job Centers in the Twin Cities Metropolitan Area (*26*)
The Twin Cities Metropolitan Area has experienced significant decentralization of population and jobs during recent decades. This study investigated job growth, job decentralization, and commuting patterns in the Twin Cities Metropolitan Area during the 1990s, focusing particularly on how these patterns affect the opportunity structures that is, the ease of access to growing job centers and adequate, affordable housing facing people of color and lower income households. The study utilized the workplace-based tables of the CTPP compiled by traffic analysis zone (TAZ) in 1990 and 2000 to identify small- and large-scale job clusters, to examine job growth by job center type, to examine commuting patterns to the job centers, and to show the racial breakdowns of the workers commuting to each center. This study used the 1990 and 2000 CTPP data compiled by TAZ to identify job centers which were defined as adjacent TAZs with greater-than-average numbers of jobs per square mile and total employment exceeding 1,000 jobs. The 1990 and

2000 CTPP data also used to analyze the racial breakdown of workers broken out—workers of Hispanic origin or other racial/ethnic backgrounds—by the type of job center they work in. Additionally, data for travel time to work of the CTPP were used for commuter-shed analysis, deriving the areas around each job center representing 20-, 30-, and 40-minute commutes in 1990 and 2000.

The results of this study indicate that, if current patterns continue, the potential for transit in the Twin Cities Metropolitan Area would decline, and consequently, job opportunities available to workers who rely on transit—lower income workers who are disproportionately people of color—will decline. Additionally, the study highlights serious shortfalls in affordable housing in fast-growing job centers and social equity implications for people working in declining job centers—limiting workers' future opportunities and lessening their potential for higher earnings in the future.

CONCLUSION

This paper explored the major data products that have been widely utilized in transportation planning and research—the CTPP, the LODES and the NHTS; and then, it examined the strengths and limitations of the CTPP workplace data as compared to the LODES and the NHTS. It is important to have a full understanding of each data's characteristics before incorporating it into a project. The CTPP workplace data has been utilized by various organizations and agencies due to its unique and rich tabulations even at small geography like census tract. Over the years, CTPP has shown a tremendous improvement in its contents from 1990 to 2010 by introducing more customized tables. Also, the CTPP workplace data generated from the ACS five-year estimates allows users to perform temporal and spatial analysis with relatively lower MOE than using the ACS one- or three-year estimates, although it still has a higher MOE than using the decennial census.

As compared to the CTPP, the LODES provides users with workplace information in more geographically detailed manner, and therefore, it allows users to perform small area analysis related to workplace and OD flows. On the other hand, the CTPP provides invaluable information for transportation planners and researchers that are not included in the LODES; and therefore, it allows users to analyze workplace and travel patterns with much more socioeconomic and travel characteristics, such as means of transportation, travel time to work, vehicle available and poverty status. Although the LODES provides the longitudinal employment statistics annually, the LODES data is not available prior to the year 2002 and it does not have a consistent information for certain variables. Also, the LODES data is not available for the whole U.S. Those limitations make it hard to perform certain longitudinal analysis, especially when users need workplace information prior to year 2002, while the CTPP allows users to utilize the workplace data back to the year 1990.

The upcoming CTPP version uses the ACS 2012-2016 five-year estimates to generate its special tabulations. On an important note, the customized tables in this upcoming CTPP version will be reduced by about one-third, as compared to the 2006-2010 CTPP. Accuracy of geocoding workplace locations is also considered an important component in improving the CTPP workplace data. Incorporating real-time mapping application for respondents when responding to ACS may improve geocoding issues. The CTPP workplace data may be integrated with other major datasets such as LODES and NHTS to unlock more unique workplace tabulations. Additionally, developing user friendly applications to easily retrieve the customized tables from the big CTPP datasets, sharing the success stories through CTPP website and professional conferences, and collaborating with partner agencies, including metropolitan planning organizations (MPO) and council of governments (COG), in the nation to provide a technical support to local jurisdictions and data users could encourage users to better utilize the CTPP workplace data in the future.

This paper also summarized the various uses and applications of the CTPP data product and its workplace data. Over 300 studies that cited the use of the CTPP data were reviewed in this paper and were grouped into 12 subject area categories based the review of the studies. According to the review results, a considerable number of research reports have been conducted on the subjects of Commuting Patterns & Job-Housing Mismatch, and Travel Demand Modeling & Forecasting, and it is expected that they will be the key subject areas in the future. The results indicate that the CTPP workplace data is useful especially

600 for transportation planning and research on the subjects of Trend Analysis & Market Research, Built
601 Environment & Accessibility Study, Policy Analysis, and Commuting Patterns & Job-Housing Mismatch.
602 Also, given that research has increased since 2000 on the subjects of Bicycle & Pedestrian Studies,
603 Environmental Justice & Title VI, and Health, Safety & Environmental Issues, and Trend Analysis and
604 Market Research, the CTPP workplace data can be more widely utilized in the future on those newly
605 emerging subject areas. Additionally, demographics may also be the emerging topic area, given
606 demographic trend of population aging, millennial generation and workforce not only in the nation.

607 **APPENDIX A: Studies that cited the use of the Census Transportation Planning Products (CTPP)**
608 **data**
609

Author / Year	Title	Subject Area(s)
Alexander et al., 2015	Assessing the Impact of Real-time Ridesharing on Urban Traffic using Mobile Phone Data	PO
Alexander et al., 2015	Origin–destination trips by purpose and time of day inferred from mobile phone data	CJ
Anas, Alex & Hiramatsu, Tomoru, 2012	The effect of the price of gasoline on the urban economy: From route choice to general equilibrium	PO
Antipova et al., 2011	Urban land uses, socio-demographic attributes and commuting: A multilevel modeling approach	TB, CJ
Appold, 2015	Airport cities and metropolitan labor markets: An extension and response to Cidell	BA
Atlanta Regional Commission, 2005	Comparison of 2000 JTW Census Data, Gravity Model Results, and SMARTRAQ Household Travel Survey Data, in the Trip Distribution Model at the ARC	MF
Baltimore Metropolitan Council , 2014	Web Application to Examine Commuting in Baltimore Region Baltimore Metropolitan	CJ
Barnes, 2005	The importance of trip destination in determining transit share	TP
Baum-Snow, 2010	Changes in Transportation Infrastructure and Commuting Patterns in US MetropolitanAreas, 1960–2000	CJ, BA
Becker et al., 2011	A tale of one city: Using cellular network data for urban planning	SD
Bhat et al., 2013	A household-level activity pattern generation model with an application for Southern California	MF, TB
Bohon et al., 2008	Transportation and migrant adjustment in Georgia	BA, TB
Boyce, David & Bar-Gera, Hillel, 2003	Validation of multiclass urban travel forecasting models combining origin-destination, mode, and route choices	MF
Bricka, 2004	Variations in Hispanic Travel Based on Urban Area Size	TB, DM
Cambridge Systematics (CS), 2017	Using Census Data to Develop Efficient Household Travel Survey Sampling Plans	SD
Cambridge Systematics , 2013	Counting Workers: Comparison of Employment Data for CPS, ACS and LODES	SD
Cambridge Systematics Inc. , 2005	Use of CTPP data in the Cook-DuPage Corridor Study	TB
Cambridge Systematics Inc. , 2009	Analysis of Iterative Proportion Fitting in the Generation of Synthetic Populations	SD
Cambridge Systematics Inc. , 2009	Model-Based Synthesis of Household Travel Survey Data	SD
Cambridge Systematics, Inc. , 2009	Disclosure Avoidance Techniques to Improve ACS Data Availability for Transportation Planners	SD
Cambridge Systematics, Inc., 2004	CTPP Workers-at-Work Compared to Other Employment Estimates	SD
Cambridge Systematics, Inc., 2011	NCHRP 08-36, Task 98 – Improving Employment Data for Transportation Planning	SD
Cambridge Systematics, Inc., 2011	Using 2006-2008 CTPP in Planning for San Juan Light Rail Transit Study	TP
Cambridge Systematics, Inc., 2014	FTA New Starts project using CTPP	TP
Cambridge Systematics, Inc., 2016	Research for the AASHTO Standing Committee on Planning. Task 127. Employment Data for Planning: A Resource Guide	SD
Capon, 2007	Health impacts of urban development: key considerations.	HS, BA

Author / Year	Title	Subject Area(s)
Case et al., 2008	Simulating the Economic Impacts of a Hypothetical Bio-Terrorist Attack: A Sports Stadium Case	PO
Catala, 2005	Florida Journey to Work GIS Web-Site	CJ
Catanzarite , 2012	Edge cites revisited: The restless suburban landscape	TA
Center for Transportation Research, 2011	Understanding Emerging Commuting Trends in a Weekly Travel Decision Frame_Implications for Mega Region Transportation Planning	CJ
Center for Urban and Regional Studies, 2012	Using CTPP 2000 Employment and worker flow data to build integrated land use-travel demand models of small communities and rural areas	MF
Center for Urban Transportation & University of South Florida, 2005	Online Web Application using Journey to Work data from CTPP 2000	CJ
Cervero & Kockelman, 1997	Travel demand and the 3Ds: Density, diversity, and design	MF, TB, BA
Cervero & Landis, 1997	Twenty years of the Bay Area Rapid Transit system: Land use and development impacts	TP
Cervero & Wu, 1997	Polycentrism, commuting, and residential location in the San Francisco Bay area.	CJ
Cervero et al., 2002	Transportation as a Stimulus of Welfare-to-Work: Private versus Public Mobility	PO
Cervero, 1994	Use of census data for transit, multimodal, and small-area analyses	TP
Cervero, 2001	Efficient Urbanisation: Economic Performance and the Shape of the Metropolis	BA
Chattanooga Transportation Planning Organization (TPO), 2015	Chattanooga-Hamilton County_North Georgia Data Collection Phase II	MF
Chen & Suen, 2010	Richmond's journey-to-work transit trip-making analysis	TP
Chen et al., 2007	Role of the built environment on mode choice decisions: additional evidence on the impact of density	TB
Chen et al., 2011	Development of Indicators of Opportunity-Based Accessibility	SD
Chirumamilla, 1998	Discrete-continuous model of household vehicle ownership and trip generation	TB, MF
Cho& Rodriguez, 2015	Location or design? Associations between neighbourhood location, built environment and walking	BA, BP
Chow et al., 2010	Subregional Transit Ridership Models Based on Geographically Weighted Regression	TP
Chu, 2012	Census/ACS/CTPP data for transit planning	TP
Chung, 2003	Temporal analysis of land use and transportation investments with geographic information system	BA
City of Madison, 2007	Downtown Madison Market Analysis	TA
Clifton et al., 2012	Household Travel Surveys in Context-Based Approach for Adjusting ITE Trip Generation Rates in Urban Contexts	SD
Coleman, 1999	Forecasting Interurban Rail Trips: An Overview of Two Scenarios	TP
Columbia University Graduate School of Architecture, Planning and Preservation, 2014	Promoting Bus Rapid Transit Options on the New Tappan Zee Bridge and I-287 Corridor	TP
COPAFS, 2012	A Preview of Small Area Transportation Data from the American Community Survey	SD
Cutsinger & Galster, 2006	There is No Sprawl Syndrome: A New Typology of Metropolitan Land Use Patterns	TA

Author / Year	Title	Subject Area(s)
Cutsinger et al., 2005	Verifying the multi-dimensional nature of metropolitan land use: Advancing the understanding and measurement of sprawl	TA
Cutsinger et al., 2005	Verifying the Multi-Dimensional Nature of Metropolitan Land Use_Advancing the Understanding and Measurement of Sprawl	BA
Delaware Valley Regional Planning Commission, 2006	Development of Zonal Employment Data for Delaware Valley Region Based on Census 2000	TA
Delaware Valley Regional Planning Commission, 2006	Evaluation of Census Transportation Planning Package 2000 for the Delaware Valley Region	SD
Deloitte, 2015	Ridesharing: the easiest (and hardest) approach to congestion reduction	PO
Denise, 2011	COMPARING METHODS FOR ESTIMATION OF DAYTIME POPULATION IN DOWNTOWN INDIANAPOLIS, INDIANA	MF
Dentel-post et al., 2017	Getting People Around After the Trains Stop Running : A Transit Propensity Index for Late-Night Service Planing	TP
Denver Regional Council of Governments (DRCOG) , 2010	Using ACS/CTPP data in Activity-Based Model Calibration	MF
Department of Sociology-Anthropology Illinois Sate University , 2002	Use of CTPP files for Analysis of Metropolitan Area Multiple Nuclei	TA
Des Moines Area MPO, 2005	U.S. Census, CTPP, And NHTS Data Used in the Des Moines Area MPO's Travel Demand Model	MF
Diao, 2015	Are Inner-City Neighborhoods Underserved ? An Empirical Analysis of Food Markets in a U . S . Metropolitan Area	BA
Dolney, 2009	Using simulation to estimate vehicle emissions in response to urban sprawl within Geauga County, Ohio	HS
Eastgate MPO, 2006	Use of CTPP at the Eastgate MPO, Youngstown, Ohio	MF
Ed, 1996	Census data use in Illinois by small metropolitan planning organizations	SD
Eisman, 2012	Spatial analysis of urban built environments and vehicle transit behavior	TB, BA
Employment and Training Institute & University of Wisconsin-Milwaukee , 2005	Neighborhoods at Work	TA
Evans, 2016	CTPP Tract-to-Tract Commute Visualization	CJ
Ewing et al., 2003	URBAN SPRAWL AND TRANSPORTATION	TA
Farber et al., 2015	Measuring segregation using patterns of daily travel behavior: A social interaction based model of exposure	TB, CJ
Farhan & Murray, 2008	Siting park-and-ride facilities using a multi-objective spatial optimization model	PO, MF
Fayyaz et al., 2017	Dynamic transit accessibility and transit gap causality analysis	TP
Federal Emergency Management Agency , 2008	HAZUS – MH: FEMA's Software Program for Estimating Potential Losses from Disasters	HS
Federal Highway Administration & Cambridge Systematics Inc, 2005	Disclosure and Utility of Census Journey-to-Work Flow data from the American Community Survey - Is There a Right Balance?	SD
Federal Highway Administration, 2007	Peak Spread of Journey-to-Work	CJ

Author / Year	Title	Subject Area(s)
Federal Highway Administration, 2008	Using Census Data to Analyze Limited English Proficiency (LEP) Populations for Transit Applications	TP, EJ
Federal Highway Administration, 2009	Vehicle Availability and Mode to Work by Race and Hispanic Origin, 2007	TB, DM
Federal Highway Administration, 2013	Commutation Flow: CTPP 2000, ACS & CTPP, and LEHD-OTM	CJ
Federal Highway Administration, 2014	How much do we spend on Housing and Transportation?	TB
Federal Highway Administration, 2014	How Hard is it to Count Workers? Self-employment data in Nonemployer statistics and in American Community Survey	SD
Federal Transit Administration, 2006	Use of CTPP 2000 in FTA New Starts Analysis	TP
Federal Transit Administration, 2010	CTPP Data to Support Transit Ridership Forecasting	TP
Federal Transit Administration, 2013	Census Data Application for Title VI Service Equity Analysis	EJ
Fredericksburg Area Metropolitan Planning Organization, 2013	Population and Employment Projection Dataset and Methodology	MF
Freedman et al., 2008	New Approaches to Creating Data for Economic Geographers	SD
Freedman, 1999	Comparing Stratified Cross-Classification and Logit-Based Trip Attraction Models	MF
Funderburg et al., 2010	New highways and land use change: Results from a quasi-experimental research design	MF, BA
Gabbe, 2017	Why Are Regulations Changed? A Parcel Analysis of Upzoning in Los Angeles	PO
Glaeser, 1996	Spatial effects upon employment outcomes: the case of New Jersey teenagers. Discussion	TB
Gottlieb & Lentnek, 2001	Spatial Mismatch is not Always a Central-city Problem: An Analysis of Commuting Behaviour in Cleveland, Ohio, and its Suburbs	CJ
Greater Buffalo-Niagara Regional Transportation Council , 2003	2002 Regional Transportation Survey	SD
Greaves, 1989	Simulating household travel survey data in metropolitan areas	MF
Greenberg & Evans, 2015	Pay-to-Save Transportation Pricing Strategies and Comparative Greenhouse Gas Reductions: Responding to Final Federal Rule for Existing Electric Utility Generating Units	HS, PO
Gregor, 1998	Assessing Intercity Commuting Patterns in the Willamette Valley Using the Census Transportation Planning Package (CTPP)	CJ
Grengs, 2010	Job accessibility and the modal mismatch in Detroit	BA, PO
Guldmann, 2013	Analytical strategies for estimating suppressed and missing data in large regional and local employment, population, and transportation databases	SD
Hampton Roads Planning District Commission , 2005	A Compendium of 2000 Census Commute Analyses for the Hampton Roads Region	CJ
Han & Zegras, 2016	Exploring Model and Behavior Uncertainty	TB
Henson, 2011	Travel Determinants and Multi-scale Transferability of National Activity Patterns to Local Populations	TB
Herb & Herb, 2007	Racial profiling and the police : utilizing the Census Transportation Planning Package to benchmark traffic stops made by the North Carolina State Highway Patrol	DM

Author / Year	Title	Subject Area(s)
Hirsch et al., 2017	Municipal investment in off-road trails and changes in bicycle commuting in Minneapolis, Minnesota over 10 years: a longitudinal repeated cross-sectional study.	BP
Holleran & Duncan, 2012	Sketch-Level Feasibility Analysis of Commuter Rail Service Between Kannapolis and Charlotte, North Carolina	TP
Homer, 2004	Spatial dimensions of urban commuting: a review of major issues and their implications for future geographic research	CJ, BA
Horner & Marion, 2009	A Spatial Dissimilarity-based Index of the Jobs--Housing Balance: Conceptual Framework and Empirical Tests	TA
Horner & Mefford, 2005	Examining the spatial and social variation in employment accessibility: A case study of bus transit in Austin, Texas	TP
Horner & Mefford, 2007	Investigating urban spatial mismatch using job-housing indicators to model home-work separation	CJ
Horner & Murray, 2003	A Multi-objective Approach to Improving Regional Jobs-Housing Balance	PO
Horner, 2002	Extensions to the concept of excess commuting	CJ
Horner, 2007	A multi-scale analysis of urban form and commuting change in a small metropolitan area (1990-2000)	CJ, TA
Horner, 2008	'Optimal' Accessibility Landscapes? Development of a New Methodology for Simulating and Assessing Jobs—Housing Relationships in Urban Regions	MF
Horner, 2010	How Does Ignoring Worker Class Affect Measuring the Jobs-Housing Balance? Exploratory Spatial Data Analysis	CJ
Houston-Galvaston Area council, 2005	How Census 2000 and CTPP 2000 Data Helped Us in the Use of Regional Travel Demand Forecast	MF
Hu & Wang, 2015	Decomposing excess commuting: A Monte Carlo simulation approach	CJ
Hu et al., 2017	Commuting Variability by Wage Groups in Baton Rouge, 1990â€“2010	CJ, EJ
Hu, 2013	Changing job access of the poor: effects of spatial and socioeconomic transformations in chicago, 1990--2010	BA, DM
HUNTSINGER, 2012	Temporal Stability of Trip Generation Models: An Investigation of the Role of Model Type and Life Cycle, Area Type, and Accessibility Variables	MF
Hwang & Thill, 2007	Using fuzzy clustering methods for delineating urban housing submarkets	SD
Immergluck, 1998	Job Proximity and the Urban Employment Problem: Do Suitable Nearby Jobs Improve Neighbourhood Employment Rates?	BA, DM
Immergluck, 1998	Neighborhood Economic Development and Local Working: The Effect of Nearby Jobs on Where Residents Work	CJ, DM
Indian Nations Council of Governments , 2011	Using 2006-2008 CTPP and CTPP 2000 Data to Evaluate the Reliability of Travel Forecast Assumption	TB
Jang & Yao, 2011	Interpolating Spatial Interaction Data	SD
Jang & Yao, 2014	Tracking Ethnically Divided Commuting Patterns Over Time: A Case Study of Atlanta	CJ, DM
Jang et al., 2014	Spatial Analysis of the Baby Boomers' Jobs and Housing Patterns in a GIS Framework	TB, DM
Jeon et al., 2015	Application of CTPP Data for validation of regional transportation forecasting models: MAG Experience	MF
Kawabata & Shen, 2007	Commuting Inequality between Cars and Public Transit: The Case of the San Francisco Bay Area, 1990-2000	TB
Kawabata , 2003	Spatial distributions of low-skilled workers and jobs in U.S. metropolitan areas	CJ

Author / Year	Title	Subject Area(s)
Kawabata, 2002	Access to Jobs: Transportation Barriers Faced by Low-Skilled Autoless Workers in US Metropolitan Areas	BA
Kawabata, 2009	Spatiotemporal dimensions of modal accessibility disparity in Boston and San Francisco	TB
Kentucky Tranportation Cabinet, 2005	Use of Census Transportation Planning Package (CTPP) Data To Update the Kentucky Statewide Traffic Model	MF
Kentucky Transportation Center, 2010	Investigating Contextual Variability in Mode Choice in Chicago Using a Hierarchical Mixed Logit Model	TB, MF
Kim & Sang, 2006	Disaggregated Travel Forecasting	MF
Kim & Hewings, 2012	Integrating the fragmented regional and subregional socioeconomic forecasting and analysis: A spatial regional econometric input-output framework	MF
Kim & Hewings, 2013	Land use regulation and intraregional population-employment interaction	PO
Kim et al., 2012	Exploring urban commuting imbalance by jobs and gender	CJ, BA, EJ
Kim et al., 2014	Exploring job centers by accessibility using fuzzy set approach: The case study of the Columbus MSA	BA, DM
Kim, 2005	Trip generation model for pedestrians based on NHTS 2001	BP
King County Department of Transportation, 1999	Guidelines for local travel demand model development	MF
Kirkpatrick, 1997	Conversion of GIS databases for modeling rural transportation networks	MF
Kockelman, 1997	Effects of Location Elements on Home Purchase Prices and Rents in San Francisco Bay Area	TA
Krenzke & Hubble, 2009	Toward Quantifying Disclosure Risk for Area-Level Tables When Public Microdata Exists	SD
Kwon, 2015	The Effects of Urban Containment Policies on Commuting Patterns	PO
Lane, 2011	TAZ-level variation in work trip mode choice between 1990 and 2000 and the presence of rail transit	TB, TA
Lanton, 1996	Small-area applications using 1990 census transportation planning package: Gaineville, Florida	MF
Larisa Ortiz Associates, 2014	Trenton Citywide Economic Market Study	TA
Layman & Horner, 2010	Comparing Methods for Measuring Excess Commuting and Jobs-Housing Balance Empirical Analysis of Land Use Changes	CJ
Lee et al., 2011	The attributes of residence/workplace areas and transit commuting	CJ, TP
Lee, 2005	A spatial analysis of disaggregated commuting data: Implications for excess commuting, jobs -housing balance, and accessibility	CJ, BA
Lee, 2006	Urban spatial structure, commuting, and growth in United States metropolitan areas	BA
Lee, 2007	Edge or edgeless cities? Urban spatial structure in U.S. Metropolitan areas, 1980 to 2000	TA
Levinson & Marion, 2010	The City is Flatter: Changing Patterns of Job and Labor Access in Minneapolis-Saint Paul, 1995-2005	TA, TB
Limoges, 1996	Improvement of decennial census small-area employment data: New methods to allocate ungeocodable workers	SD
Lin & Long, 2006	What Neighborhood Are You In? Empirical Findings on Relationships Between Residential Location, Lifestyle, and Travel	TB
Lin & Long, 2008	What neighborhood are you in? Empirical findings of relationships between household travel and neighborhood characteristics	TB, DM
Lindfors, 2012	Exploring the commuting interactions of neighboring metropolitan areas	CJ

Author / Year	Title	Subject Area(s)
Linesch , 2012	Building a Statewide Traffic Count Database : A California Statewide Travel Demand Model Application	MF
Liu et al., 2009	Using GIS and CTPP Data for Transit Ridership Forecasting in Central Florida	TP
Long et al., 2014	Model-Based Synthesis of Household Travel Survey Data in Small and Midsize Metropolitan Areas	SD
Long, Liang & Lin, Jie, 2007	An Investigation in Household Mode Choice Variability across Metropolitan Statistical Areas for Urban Young Professionals	TB
Lu, 2015	Urban Mobility Evaluation Using Small-Area Geography and High-Resolution Population Data	CJ
Luce et al., 2006	Access to growing job centers in the Twin Cities metropolitan area	TA
Madison Metropolitan Planning Area, 2006	Environmental Justice Analysis - Madison Area Transportation Regional Transportation Plan 2030	EJ
Maricopa Association of Governments, 2015	Use of GIS in the Validation of Travel Forecasing Models	MF
Maricopa Association of Governments (MAG) , 2017	Application of ACS and CTPP Databases in Environmental Justice Assessment—Examples from MAG	EJ
Massachusetts Institute of Technology, 2009	The Effectiveness of Job-housing Balance as a Congestion Relief Strategy	CJ, PO
Matsuo, 2013	Competition over High-income Workers: Job Growth and Access to Labour in Atlanta	DM
McCahill & Garrick, 2012	Automobile use and land consumption: Empirical evidence from 12 cities	MF
McCahill, 2012	The Influence of Urban Transportation and Land Use Policies on the Built Environment and Travel Behavior	BA, TB
McCall et al., 2016	A County Level Methodology to Study the Impact on Emissions and Gasoline Tax Revenue of Plug-In Hybrid Electric Vehicles in New Jersey	PO, HS
Mccall et al., 2016	Effect of plug in hybrid electric vehicle adoption on gas tax revenue, local pollution and greenhouse gas emissions	HS
McGill University , 2010	The Spatial Patterns Affecting Home to Work Distances of Two-Worker Households	CJ
Mcneely, 2007	Development of a Ridership Forecasting Tool for Small Public Transit Systems Using GIS	TP
Metro North Rail , 2015	Measuring change in transit ridership for a new mode using ACS: the case of hudson bergen light rail and light rail overall	TP
Metropolitan Transit Authority & New York City Transit, 2004	Second avenue subway in the borough of Manhattan, New York County, New York	TP
Metropolitan Transportation Commission, 2005	Environmental Justice for Long-Range Regional Transportation Plans: Using Census Data to Target Communities of Concern	EJ
Metropolitan Transportation Commission, Oakland , 2003	Commuting Patterns of Immigrants	CJ, DM
Mishra et al., 2011	A functional integrated land use-transportation model for analyzing transportation impacts in the Maryland-Washington , DC Region	PO, MF
Mississippi River Regional Planning Commission, 2017	Commuter Feasibility Study - Arcadia to La Crosse and Tomah to La Crosse	TP

Author / Year	Title	Subject Area(s)
Missoula Metropolitan Planning Organization, 2015	2016 Missoula Long Range Transportation Plan	MF
Mix, 2005	Evaluating the local employment dynamic program as an alternate source of place of work data for use by transportation planners	SD
Mohan, 2004	Household Travel Survey Data Fusion Issues	SD
Moore & Campbell, 2014	The correlates of congestion: Investigating the links between congestion and urban area characteristics	PO
MTA New York City Transit , 2013	New York City Transit's Environmental Justice Strategies: Using CTPP Journeyto-Work Data to Perform Service Change Impact Analysis by Demographics	EJ, PO
Mulbrandon, 2007	An agent-based model to examine housing price, household location choice, and commuting times in Knox County, Tennessee	MF
Murakami et al. , 2014	Workplace Geocoding Issues	SD
National Academic of Science , 2012	Smoothing the Borders of Labor markets and payment areas: use of the "Journey to Work" data in recommendations to refine Medicare's geographic payment adjusters	HS
National Research Council et al., 1994	Historic uses of census data in transportation planning and future needs	SD
National Research Council et al., 1994	The decennial census and transportation planning: Planning for large metropolitan areas	PO
Nelson et al., 2007	Transit in Washington, DC: Current benefits and optimal level of provision	TP, PO
New York State DOT, 2011	Commuting Flow: CTPP 2000, ACS and CTPP, and LEHD-OTM	CJ
New York University Wagner School of Public Service, 2010	The high-speed rail development in the Northeast megaregion of the United States_A conceptual analysis	TP
Newburger et al., 2011	The City in the Twenty-First Century: Neighborhood and Life Chances : How Place Matters in Modern America	TA
Newman & Bernardin, 2010	Hierarchical ordering of nests in a joint mode and destination choice model	MF
North Central Texas of Governments , 2017	Using CTPP Data to Segment Households and Employment	MF
Nyerges & Orrell, 1992	Using geographic information systems for regional transportation planning in a growth management context	PO
Ogura, 2010	Effects of urban growth controls on intercity commutin	PO, CJ
O'Regan & Quigley,		BA, DM
Pan & Ma, 2006	Employment Subcenter Identification : A GIS-Based Method	TA
Pan et al., 2014	Effects of Rail Transit on Residential Property Values: Comparison Study on the Rail Transit Lines in Houston, Texas, and Shanghai, China	TP
Pan, 2003	Non-survey regional freight modeling system	MF
Pan, 2006	Freight Data Assembling and Modeling: Methodologies and Practice	MF
Parsons Brinckerhoff, 2006	Calculating/Analyzing Transit Dependent Populations Using 2000 Census Data and GIS	TP
Paschai et al., 2011	The Use of ACS and Decennial Census Data Products in the Demographic Forecasting Process at NCTCOG	MF
Principal of Schaller Consulting , 2007	Use of CTPP to assess transit access to the Manhattan CBD	TP
Public Policy Institute of California, 2004	Transportation Spending by Low-Income California Households: Lessons for the San Francisco Bay Area	TB, EJ

Author / Year	Title	Subject Area(s)
Rae, 2015	Mapping the American Commute: from mega-regions to mega commutes	CJ
Rahmani , 2013	Aggregate relation between residence and workplace travel time in large urban areas	CJ
Rashidi & Mohammadian, 2011	Household travel attributes transferability analysis: Application of a hierarchical rule based approach	MF
Rashidi et al., 2012	A behavioral housing search model: Two-stage hazard-based and multinomial logit approach to choice-set formation and location selection	MF
Regional Transportation Authority , 2006	Northeastern Illinois CTPP Journey to Work Flow Summaries	CJ
Regional Transportation Authority Chicago, Illinois, 2009	Interactive CTPP Analysis Using RTAMS for Northeastern Illinois : A Web-Based Analysis Tool (An Online Journey to Work Data Application)	TB
Rensselaer Polytechnic Institute, 2013	Conduct Urban Agglomeration with the Baton of Transportation: Effects of Jobs-Residence Balance on Commuting Pattern	CJ
Roanoke Valley Transportation, 2017	Vision 2040: Roanoke Valley Transportation	PO
Rothblatt & Colman, 1997	Comparative study of statewide transportation planning under ISTEA	SD
Rudin Center for Transportation, 2012	The emergence of the 'supercommuter'	CJ
Sabre Systems Inc., 2004	Allocation of Missing Place of Work Data in Decennial Censuses and CTPP 2000	SD
Sailor & Lu, 2004	A top–down methodology for developing diurnal and seasonal anthropogenic heating profiles for urban areas	HS
Saint Mary's University of Minnesota, 2009	Geographic Information Systems and the Economic Structure of the Seven Rivers Region	TA
Salem-Keizer MPO , 2000	Use of CTPP for Transportation Planning and Modeling in the Salem-Keizer (Oregon) MPO	MF
San Diego Associations of Governments, 2005	Getting Around Rounding and Suppression Issues with CTPP	SD
Sandoval et al., 2011	The transition from welfare-to-work: How cars and human capital facilitate employment for welfare recipients	BA
Sang et al., 2011	Examining Commuting Patterns: Results from a Journey-to-work Model Disaggregated by Gender and Occupation	CJ, DM
Sang, 2008	Examining commuting patterns and spatial mismatch by occupation and gender: Disaggregate journey -to -work model	CJ, DM
Santa Barbara County Association of Governments, 2014	Santa Barbara County State of the Commute	CJ
Seattle Office of Housing , 2007	Gaining Clues to Seattle's Workforce Housing Needs	TA
Sen et al., 1995	Household Travel Survey Nonresponse Estimates : The Chicago Experience	SD
Serulle & Cirillo, 2016	Transportation needs of low income population: a policy analysis for the Washington D.C. metropolitan region	EJ, PO, TP
Severen, 2017	Commuting, Labor, and Housing Market Effects of Mass Transportation: Welfare and Identification	CJ
Sherman-denison Metropolitan Planning Organization , 2012	Sherman-denison Metropolitan Planning Organization annual report	PO
Sivanandan et al., 2007	Method To Enhance Performance of Synthetic Origin-Destination Trip-Table Estimation Models	SD

Author / Year	Title	Subject Area(s)
Smart, 2014	A nationwide look at the immigrant neighborhood effect on travel mode choice	TB
Southeast Michigan Council of Governments, 2014	Using CTPP Data to Visualize Commuting Patterns in Southeast Michigan	CJ
Southern California Association of Governments, 2015	Visualization of Origin-Destination Commuter Flow Using LEHD Origin-Destination employment statistics (LODES) data	CJ
Southern California Association of Governments, 2016	Spatial and Socioeconomic Analysis of Commuting Patterns in Southern California: Using LEHD Origin-Destination Employment Statistics (LODES), Census Transportation Planning Products (CTPP) and ACS Public Use Microdata Sample (PUMS)	CJ, DM, EJ
State of Maryland, 2013	The Maryland Statewide transportation model	MF
Sultana & Weber, 2007	Journey-to-work patterns in the age of sprawl: Evidence from two midsize Southern metropolitan areas	CJ, BA
Sultana, 2002	Job/Housing Imbalance and Commuting Time in the Atlanta Metropolitan Area: Exploration of Causes of Longer Commuting Time	CJ
Sultana, 2005	Racial variations in males' commuting times in Atlanta: What does the evidence suggest?	CJ, DM
Sultana, 2005	Effects of Married-Couple Dual-Earner Households on Metropolitan Commuting: Evidence from the Atlanta Metropolitan Area	CJ
Sweet, 2013	Traffic Congestion's Economic Impacts: Evidence from US Metropolitan Regions	PO
Tal & Handy, 2010	Travel behavior of immigrants: An analysis of the 2001 National Household Transportation Survey	TB, MF, EJ
Texas A&M Transportation Institute, 2015	Austin State Agency Congestion Footprint	PO, CJ
Thaithatkul et al., 2015	A Passengers Matching Problem in Ridesharing Systems by Considering User Preference	PO
The Association of American Geographers , 2007	GIS integration of daily commuting movement and population density surface model	MF
The Champaign County , 2015	The Champaign County Travel Demand Model	MF
The Florida Department of Transportation , 2016	Guidebook for Florida stops applications	MF
The University of Tennessee Center for Transportation Research , 2008	Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee	MF
Transport Foundry, 2015	Using passive data to build an agile tour-based model - a case study in Asheville	MF
Transportation Research Board and the Division on Engineering and Physical Sciences, 2008	Metropolitan Spatial Trends in Employment and Housing	TA
Transportation Research Board, 2006	Commuting in America 2006	CJ, TA
Transportation Research Board, 2011	Research for the AASHTO Standing Committee on Planning. Task 111. U.S. Commuting and Travel Patterns: Data Development and Analysis	CJ, TB
TranSystems Corporation , 2006	The Use of CTPP Data for Commuter Rail Demand Analysis in Danbury Connecticut	TP

Author / Year	Title	Subject Area(s)
Tri-County Regional Planning Commission et al., 1997	Socioeconomic Forecasting Model for the Tri-County Regional Planning Commission	MF
U.S. Census Bureau: American Community Survey, 2011	Commuting in the United States: 2009	CJ, TA
University of California Transportation Center (UCTC), 1995	Job Accessibility as a Performance Indicator: An Analysis of Trends and Their Social Policy Implications in the San Francisco Bay Area	BA
University of Kentucky, Lexington, 2014	Intercounty Commuter Public Transit Services and Opportunities in the Central Bluegrass	TP
University of North Carolina at Chapel Hill , 2014	Using CTPP Data to Improve the Wichita Area Trip Distribution Model	MF
University of South Florida, 2007	Development of alternative measures of transit mode share	TP
University of Southern California, 2006	The US context for highway congestion pricing	PO
University of Texas at Austin , 2014	Understanding Transit Ridership Demand for the Multidestination, Multimodal Transit Network in Atlanta, Georgia: Lessons for Increasing Rail Transit Choice Ridership while Maintaining Transit Dependent Bus Ridership	TP, TB
University Transportation Center for Alabama, 2005	The Impact of Sprawl on Commuting in Alabama	PO, CJ
Upchurch & Kuby, 2014	Evaluating light rail sketch planning: Actual versus predicted station boardings in Phoenix	TP, MF
Urban Transportation Center, UIC, 2013	Analysis of Travel Behavior Using the ACS	TB, DM
Urbanomics, 2005	Trip making, induced travel demand, and accessibility	MF
UrbanTrans Consultants Parsons Brinckerhoff, 2005	Portland Metro Rideshare_Market Research and Implementation Plan	TP
VanLandegen Chen, Xuwei, 2012	Micro-simulation of large scale evacuations utilizing metrorail transit	TP
Walker et al., 1997	updating existing travel simulation Models with Small-Sample Survey Data Using Parameter Scaling Methods	MF
Wall, 2001	Use of 1990 CTPP and NCHRP 365 Report to Build a Travel Demand Model for Las Cruces, New Mexico	MF
Wang & Monor, 2003	Where the jobs are: Employment access and crime patterns in Cleveland	HS, BA
Wang & Wang, 2013	Modeling Population Settlement Patterns Using a Density Function Approach: New Orleans Before and After Hurricane Katrina	MF
Wang et al., 2011	Street centrality and land use intensity in Baton Rouge, Louisiana	BA
Wang et al., 2012	Incremental Integration of Land Use and Activity-Based Travel Modeling	MF
Wang et al., 2013	Incremental Integration of Land Use and Activity-based Travel Modeling: Using CTPP2000 for Model Validation and Calibration	MF
Wang, 2000	Modeling Commuting Patterns in Chicago in a GIS Environment: A Job Accessibility Perspective	CJ
Wang, 2000	Modeling Commuting Patterns in Chicago in a GIS Environment: A Job Accessibility Perspective	CJ, BA
Wang, 2001	Explaining intraurban variations of commuting by job proximity and workers' characteristics	CJ, DM

Author / Year	Title	Subject Area(s)
Wang, 2003	Job Proximity and Accessibility for Workers of Various Wage Groups	TB, DM
Wang, 2005	Job access and homicide patterns in Chicago: An analysis at multiple geographic levels based on scale-space theory	BA
Wang, 2005	Job access and homicide patterns in Chicago: An analysis at multiple geographic levels based on scale-space theory	BA, HS
Wang, 2011	Job density and employment subcenters in the four U.S. metropolitan areas	TA
Wang, 2012	Modeling population patterns in New Orleans 2000-2010 : a density function approach	TA
Weber & Sultana, 2008	Employment Sprawl, Race and the Journey to Work in Birmingham, Alabama	CJ, BA
Weigel, 2012	Development of a commercial building/site evaluation framework for minimizing energy consumption and greenhouse gas emissions of transportation and building systems	HS
Weinberger, 2012	Death by a thousand curb-cuts: Evidence on the effect of minimum parking requirements on the choice to drive	TB, PO
Welch et al., 2005	The effects of ozone action day public advisories on train ridership in Chicago	PO, TB, HS
Widener & Horner, 2011	A hierarchical approach to modeling hurricane disaster relief goods distribution	PO
Wilbur Smith Associates & Kentucky Transportation Cabinet, 2005	Using Census Data to Develop a New Kentucky Statewide Traffic Model	MF
Wilbur Smith Associates , 2007	Using CTPP 2000 Data for the Trans Texas 35 Corridor Model	MF
Wiosna, 2015	Changing bike mode share between time periods for Suffolk County, MA	BP
Woo & Guldmann, 2011	Impacts of Urban Containment Policies on the Spatial Structure of US Metropolitan Areas	PO
Woo & Guldmann, 2014	Urban containment policies and urban growth	PO
Woo et al., 2014	Impacts of the Low-Income Housing Tax Credit Program on Neighbohood Housing Turnover	PO, EJ
Xiao, 2015	Spatial representation in the social interaction potential metric: An analysis of scale and parameter sensitivity	BA
Yang & Ferreira, 2008	Choices versus choice sets: A commuting spectrum method for representing job - Housing possibilities	CJ
Yang & Ferreira, 2009	Informing the public of transportation-land use connections	PO
Yang & Salling, 2002	Integrating GIS and DMBS to Deliver Computation Support on Job Accessibility	BA
Yang, 2005	Commuting impacts of spatial decentralization: A comparison of Atlanta and Boston	CJ
Yang, 2005	The Spatial and Temporal Dynamics of Commuting: Examining the Impacts of Urban Growth Patterns, 1980-2000	CJ, TA
Yang, 2008	Policy implications of excess commuting: Examining the impacts of changes in US metropolitan spatial structure	CJ, TA
Yao, 2007	Where are public transit needed - Examining potential demand for public transit for commuting trips	TP, MF
Yoon et al., 2012	Feasibility of using time–space prism to represent available opportunities and choice sets for destination choice models in the context of dynamic urban environments	MF
Zhan & Chen, 2008	Intercity commute patterns in central Texas	CJ

Author / Year	Title	Subject Area(s)
Zhang, 2008	Metropolitan dynamics of accessibility, diversity, and locations of population and activities	TA, BA
Zhang, 2015	Impacts of Enterprise Zone Policy on Industry Growth-New Evidence from the Louisville Program	PO

Note: Abbreviations for Subject Area Categories are as follows:

BP – Bicycle and Pedestrian Studies
BA – Built Environment and Accessibility Study
CJ – Commuting Patterns and Job-Housing Mismatch
DM – Demographics Study
EJ – Environmental Justice and Title VI
HS – Health, Safety and Environmental Issues
PO – Policy Analysis
SD – Survey, Data Synthesis and Research Methods
TP – Transit Planning
TB – Travel Behavior Analysis
MF – Travel Demand Modeling and Forecasting
TA – Trend Analysis and Market Research

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